EXISTING PLANT CONSIDERATIONS FOR A TELEPHONE SYSTEM DESIGN

CONTENTS

1. GENERAL

1.1 This section provides REA borrowers, consulting engineers, contractors, and other interested parties with information for use in the design of borrowers' telephone systems. It presents, in particular, basic considerations involved in the preparation of a telephone system design. This section partially replaces Section 205, Issue No. 4, March 1963, "Preparation of an Area Coverage Design" and its addenda. Issue 5 of Section 205 contains sample area coverage design. TE & CM-204 covers engineering and design considerations related to telephone system design.

1.2 It is helpful in the preparation of a telephone system design to follow a logical plan of action to minimize the engineering work required. The steps outlined in this section and in TE & CM-204 "Telephone System Design" have evolved over the past twenty years.

1.3 The design for an REA borrower's telephone system should be essentially the most economical and practicable design for constructing the telephone system necessary to meet the 5-year demands for service and to provide for the expansion of the system with a view to meeting the estimated future demand in an orderly manner. It will necessarily be based on the extent, nature, and location of the demand for telephone service in the area which is determined by the Area Coverage Survey (ACS). (See REA Bulletin 322-1: TE & CM-206.)

1.4 Prior to undertaking the design, the completed results and narrative of the ACS, as performed by the engineer or by the owner, and as approved by all interested parties, must be available to the engineer.

1.5 If the engineer does the field work for the ACS, information for use in the design may be obtained in the field simultaneously; thus, resulting in savings to the borrower in preloan expense.

1.6 Good system design can provide for the maximum of service desired by the subscribers at the minimum annual expense. Poor design on the other hand can result in excessive costs and inability of the system to meet subscriber service and growth demands. The ACD is a major engineering and economic factor influencing the cost of service and the adequacy of service it can offer.

1.7 The cost estimate for construction of the system, which is provided as a part of the loan submission is a primary basis for a loan. The analysis of the market for telephone service provided by the ACS is needed for design purposes and also provides the principal information needed to estimate the revenue which will be earned by the system. Both the analysis and the revenue estimate enter into the determination of the feasibility of the loan. From these factors, it can be seen that much emphasis should be placed on the necessity for careful and prudent judgment on the part of the engineer in the preparation of the ACD to serve the market established by the ACS.

2. SUBSCRIBER SERVICE EVALUATION

2.1 The Area Coverage Survey is fundamental to the entire system design and consequently to the loan itself. It is necessary to review the subscriber information and other pertinent facts and determine that the material is entirely satisfactory as a basis for proceeding with the design. The survey data should have the approval of the owner, the REA telephone Loans and Operations Field Representative and Field Engineer as to accuracy and completness before proceeding with the system design studies.

2.2 There has been considerable progress made in recent years in upgrading rural telephone service. REA recommends a standard service offering of one-party on an exchange basis wherever feasible. Where four-party service is tentatively proposed in the ACS, alternate cost studies should be included to show the cost differential between one and four-party service and all one party. There should be agreement by the owner and REA on the selection of service to be offered before the engineer completes the design.

2.3 During the period of preparation of the design the engineer should be kept informed by the owner of <u>significant</u> changes involving potential subscribers or subscriber arrangement so that the design and cost estimates can be adjusted to reflect the current subscriber demands. Such changes are subject to the review and concurrence of the REA field representatives.

2.4 Two types of switching service are sometimes provided when the company providing the central office equipment does not provide the outside plant. Service Stations, as defined by REA, are those stations switched by the <u>borrowers'</u> central office equipment. "Switcher Stations," as defined

by REA, are a large number (not Foreign Exchange) of subscribers of the borrower switched by central office equipment owned by another system. These arrangements can cause operational and maintenance difficulties and therefore are being discontinued at an accelerating rate. It is preferable for a single telephone company to serve the entire rural and urban communities. The engineer should thoroughly analyze all alternatives and assist the owner in negotiations before recommending a design including "Switchers" or "Service Stations." Additional information regarding switched lines will be found in REA Bulletin 320-13.

3. PRELIMINARY INSPECTION AND FIELD SURVEY

3.1 It is necessary that a field survey of the project area be made by the engineer prior to undertaking the design, to determine, among other things, the location and general condition of the existing telephone plant.

3.2 Since maps will be needed for the design and later in the construction and operation of the system, the engineer, prior to undertaking the field survey should obtain the base maps from which the system maps will be prepared. Design maps or up-to-date "as constructed" maps may be available to serve as work sheet maps and as a basis for revised maps of the project. For areas not previously served, the base maps may be county or state highway planning, electric utility, or other suitable maps showing establishments. These base maps can then be used as work sheet maps and the necessary field data recorded on them.

3.3 The field survey will also give the engineer an opportunity to become familiar with the general features of the area in which the telephone plant will be constructed. Local characteristics of the project area should be carefully ascertained so that such factors as the adaptability of the soil conditions for buried plant construction will be known. Additional conditions which should be evaluated are: (1) Right-of-way, (2) electrical grounding conditions, (3) severity of lightning exposure, (4) gopher activity and (5) any potential construction problems.

4. EXISTING PLANT SURVEY AND ANALYSIS

4.1 There are five major purposes in making a survey of the existing plant:

4.11 To secure information on the physical condition of the existing plant and to classify the facilities into (1) those which must be retired (little detail is required) and (2) those which have sufficient remaining life to be retained if compatible with the design or capable of economical modification to conform with it.

4.12 To secure information for estimating the cost of removal and salvage value of plant to be retired.

4.13 To secure information for estimating the original cost of plant to be retained when the plant records are inadequate.

4.14 To secure information for estimating the cost of modifying plant to be retained.

4.15 To secure information on the practicallity of reinforcing with station carrier.

4.16 To obtain information on joint use of poles and the practicallity of continuing joint use.

4.2 Physical Inspection and Appraisal

4.21 The preliminary survey of telephone plant for possible retention in the proposed system segregates the plant into comparatively few groups. Data should be subdivided into rural or urban categories if there are towns with populations of more than 1500.

4.22 Information on plant ownership, number of subscribers, and route mileage should be developed separately for each acquisition.

4.23 For cable plant, the engineer should obtain the length in kilofeet, gauge, size and type of cable, and its approximate age from the system records or field survey. An accurate automobile odometer reading to the nearest tenth of mile will be satisfactory for most measurements. The cable should be tested if there is any doubt concerning its electrical or mechanical characteristics.

4.24 For aerial, open wire or rural distribution wire, being considered for retention, the average age, pole height and class, type and gauge of wire, guys, transposition system and the average number of poles per mile in a given section of the line should be noted.

4.25 It is not practicable to survey each station installation, (this will be done during staking), but a sufficient number of station installations should be inspected to determine the general condition of station apparatus, inside wires, protectors, ground wires, drop wires, and the method of grounding. The owner's records should be checked (extensively if necessary) to determine the make, type, and approximate date of installation of station equipment and wiring and the makes and types of ringers and protectors.

4.26 The central office equipment must be inventoried, as appropriate for its condition and recommended disposition.

4.27 Existing buildings being considered for retention should be studied to determine their suitability as to size, general structural condition, and state of repair. Particular attention should be given to the space available for future carrier and other electronic equipment and main frame requirements. If an existing exchange is being upgraded from 8 to 4 parties per line to one party, it may be necessary to terminate four or more times the cable pairs or station carrier units for the new system. Fire hazards should not be overlooked. Insurance rates for the continued use of the structure should be evaluated.

4.28 Information should be obtained concerning the location and size of all land owned and its usefulness judged.

4.29 Large quantities of materials and supplies on hand should be examined for usability in construction of new plant. The approximate dollar value should be established and the portion estimated for use in the proposed construction determined. Furniture, fixtures, tools, and work equipment should be appraised as to condition, suitability, and value.

4.3 Guidelines Pertaining to Existing Plant

4.31 In most situations there will be substantial amounts of existing plant, whose continued use will need to be considered in the design of the new system. The extent to which existing plant should be utilized in a particular situation will depend primarily upon the following factors:

4.311 The existing plant proposed for use in the expanded system must be suitable as is or capable of modification more economically than it can be replaced.

4.312 The physical condition of existing plant must be such that its continued use is more economical over at least a 5-year period than replacement by new plant. The economic considerations should be based on a comparison of the annual costs of retaining the existing plant to the annual costs of the replacement by new plant.

4.32 An important aspect in the utilization of
of an expanded system is the condition of
point of remaining life and suitability as part o
the new plant will utilize materials and equipmen
life, it may be undesirable and uneconomical in s
it with certain portions of plant having material

4.33 Plant such as telephone sets, drop wire, single circuit leads will be rather easy to replace at a later date without severe cost penalties or widespread effects on service to many parts of the system. In considering plant retention, this type of plant should not be treated with the same importance as central office equipment, buildings or cables, which will be more costly to replace or rebuild later. Any troubles arising with it will affect service over large parts of the system.

4.34 Except for cable plant in very good condition, the most effective approach to the question of reuse of existing plant is to first find the optimum design of the new system considering the long range requirements. Then the design should be reviewed carefully and modified as appropriate to utilize the existing plant to the extent that such reuse will be economical in the overall design.

4.35 Where the outside plant of an existing system is in good condition, a portion of it will nearly always be usable on an economical basis in the new system. This is generally true for plastic jacketed cable. Some parts of the plant will be inadequate and because of the increased number of circuits involved in the new system replacement may have a lower annual cost (due principally to maintenance). Station carrier can sometimes be used advantageously in these situations.

4.36 REA TE & CM-215, "Rehabilitation of Existing Outside Plant" gives additional information regarding considerations involved in economical retention of telephone plant.

4.37 Many existing dial offices lack sufficient size and versatility to become a suitable switching center for the proposed system contemplated. Many of these offices have already had one or more equipment additions. While some are quite new, others have equipment that has nearly completed its useful life. If it appears that the office may have useful life remaining but a larger size is dictated, it may be practical to move line groups to other locations with similar equipment and to also use some of the power equipment at other offices.

4.4 The engineer upon completion of the evaluation of existing plant for purposes of possible retention, should proceed with the design of the proposed system. When the system design is completed and it is known what part of the existing plant the engineer recommends to remain in service, the original cost of this portion of the plant must be determined or estimated.

4.5 For a further discussion and additional considerations concerning telephone system design criteria, see REA TE & CM-204, "Telephone System Design," and REA TE & CM-205, Issue 5, "Presentation of an Area Coverage Design," this section illustrates a design including cost estimates and maps.